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# **DIFFERENCES IN THE PRODUCTIVITY LEVELS OF OLDER WORKERS IN THE EU – A CROSS-COUNTRY ANALYSIS OF THE AGE–WAGE RELATIONSHIP**

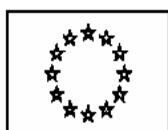
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**MATEUSZ WALEWSKI**

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**Mateusz Walewski\***

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## **Abstract**

As the process of population ageing in Europe carries on and the retirement age rises, the relationship between age and productivity becomes increasingly important. There is concern that as the average age of the working individual goes up, the average rate of productivity growth will go down, resulting in the decreasing competitiveness of European economies. Furthermore, it could be expected that owing to serious differences in the labour market structures between the new member states (including current candidates) and the EU-15, the former are likely to be among the first countries to experience higher than average productivity costs owing to an ageing workforce in the near future. This report examines this hypothesis.

The research strategy applied in this study is based on the assumption that, in general, wages are correlated with productivity at the individual level and as such can be used as a proxy for productivity. Such an assumption is quite risky and can be easily criticised. Hence, based on the results of earlier studies, the main empirical analysis is limited to groups of workers for which it can be expected that the correlation between productivity and wages remains substantial.

Bearing in mind all these caveats, the results of the analysis show that the relative productivity of older workers in the new member states is lower than it is in the EU-15.

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# **DIFFERENCES IN THE PRODUCTIVITY LEVELS OF OLDER WORKERS IN THE EU – A CROSS-COUNTRY ANALYSIS OF THE AGE–WAGE RELATIONSHIP**

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## **1. Introduction**

As the process of population ageing in Europe carries on and the retirement age rises, the relationship between age and productivity becomes increasingly important (Carone et al., 2005). There is concern that as the average age of the working individual goes up, the average rate of productivity growth will go down, resulting in the decreasing competitiveness of European economies. There are a number of studies that attempt to assess the relationship between age and productivity and the shape of the age–productivity curve (see for example Skirbekk, 2003). This research report, however, does not try to answer questions concerning the existence of the productivity decline with age or its extent. More specifically, it aims at showing that the process as such may not be homogenous across Europe.

The initial expectation here is that the EU's new member states (NMS)<sup>1</sup> will be among the first countries to experience higher than average productivity costs owing to an ageing workforce in the near future. This likelihood may stem from major differences in labour market structures between these countries (including current candidates) and the EU-15. The convergence process results in rapid restructuring and technological change, leading to progressively more human-capital intensive jobs, yet the current education level and continuous learning participation of the older labour force is much lower in the NMS than it is in the EU-15. It can be surmised that the lower (average) employment rates of older workers in the NMS are a manifestation of these processes.

The aim of this research is twofold. First, it examines the hypothesis that older workers in the NMS are currently less productive (in relation to their younger counterparts) than those in other EU member states. Second, this study attempts to find evidence that this productivity gap, if present, influences the current employment rates of older workers in the NMS. If both of these assumptions are true, and if structural differences between the labour markets of the NMS and the EU-15 continue for the next several years, there could be serious consequences for the NMS with respect to their ability to meet the employment targets of the Lisbon strategy. These trends may equally result in lower overall productivity gains, limiting the GDP growth potential of these countries and therefore of the EU as a whole.

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<sup>1</sup> Reference is made here to the 10 countries that joined the European Union on 1 May 2004, and especially to 8 of them (excluding Malta and Cyprus). The EU-15 refers to the 15 EU member states before this date.

The research strategy applied in this study is based on the assumption that, in general, wages are correlated with productivity at the individual level and as such can be used as a proxy for productivity. Such an assumption is quite risky and can be easily criticised. Hence, based on the results of earlier studies, the main empirical analysis is limited to groups of workers for which it can be expected that the correlation between productivity and wages remains substantial.

Bearing in mind all these caveats, the results of the analysis show that the relative productivity of older workers in the NMS is lower than it is in the EU-15. The study also finds some evidence that the lower employment rates of older workers in the NMS are related to these productivity differences. Employment rate differences within the NMS and the EU-15 can be held to depend on wage arrangements.

The report is organised as follows: section 2 provides some theoretical considerations concerning the age-productivity relationship. Section 3 tries to explain why the NMS are expected to suffer from a lower relative productivity rate of older workers than the EU-15. Sections 4 to 7 present the results of the empirical analysis and section 8 attempts to relate the age-productivity differences of older workers to the employment rate. Section 9 concludes.

## **2. Some theory**

This study is devoted to the widely discussed issue of the productivity decline of older workers and its consequences for total productivity dynamics in the face of an ageing population. This issue continues to be prominent in economic literature.

Productivity can decline with age for numerous reasons. The economic (and medical) literature has devoted the majority of its attention to the two most distinct phenomena: diminishing physical abilities (see Kleemeier, 1954; Shephard, 1999; and Ilmarinen et al., 1997) and declining cognitive abilities (see Greller & Simpson, 1999; Park, 1994). The lack of physical abilities and to an even larger extent cognitive abilities can be easily overcome by accumulated working experience, often resulting in a better quality of the work performed (see Czaja & Sharit, 1998). Conversely, as Keyfitz (1984) suggested, in an era of rapid changes, less depends on the accumulation of experience than on its discard and replacement.

In general, therefore, it may be expected as suggested by Skirbekk (2003) that the loss of productivity with age will be more pronounced in jobs where performance depends more on physical power and the speed of working, learning and problem-solving, and less so in jobs where experience and verbal skills are more important. This expectation implies that a productivity decline with age is not homogeneous: it can depend on numerous factors such as the level, quality and adequacy of education, the specific characteristics of industries and jobs, and the pace of technological change. Since countries differ with respect to all of these factors, the ageing effect on productivity will not be the same across countries.

For example, current and future education levels depend on previous/current schooling participation, while the quality and adequacy of education depend on the quality of the curricula. The productivity decline will probably be more acute in countries with more developed or with currently more rapidly developing high-tech industries (see Daveri & Meliranta, 2006), since the pace of technological change depends on numerous country-specific factors. These factors include the dynamics of the industrial structure, the degree of openness of the economy and its changes, the current level of technological progress (owing to technological convergence) and possibly many others.

In order to better illustrate the possible mechanics behind the age–productivity relationship, let us consider the simple human capital wage/productivity model based on that applied in Neumark & Taubman (1994):

$$w_t = -k_t + \beta(H_t - \delta_t) \quad (1)$$

where  $w_t$  stands for wage at time  $t$ , being in this model equal to productivity and  $k_t$  is the effort put into acquiring new knowledge instead of working, i.e. the value of human capital investment in time  $t$  and comes into the model with a negative sign.  $H_t$  is the human capital accumulated until time  $t$  (knowledge and experience) that is positively influencing performance and  $\delta_t$  is the depreciation of human capital in time  $t$ .

Now let us assume that

$$k_t = k(t) \text{ and } k'(t) \leq 0 \text{ and } k''(t) > 0 \text{ and } \lim_{t \rightarrow \infty} k(t) = 0 \quad (2)$$

$$H_t = \int k_t dt \Rightarrow dH_t/dt = k_t \quad (3)$$

$$\delta_t = \delta(t) \text{ and } \delta'(t) \geq 0 \text{ and } \delta''(t) > 0 \text{ and } \lim_{t \rightarrow \infty} \delta(t) = \infty \quad (4)$$

Differentiating (1) in respect to  $(t)$  we obtain

$$dw_t/dt = -dk_t/dt + \beta(k_t - d\delta/dt) \quad (5)$$

The shape of the age–productivity profile as described by (5) depends, in this simple model, on the relation between  $k_t$ ,  $k'(t)$  and  $\delta'(t)$ . In the special case of a constant (or zero) depreciation of knowledge/human capital, the age–productivity profile strictly increases as in the original version of this model used in Neumark & Taubman (1994). In other cases, the age–productivity profile increases at the beginning of the career and depends mainly on how much we learn ( $k_t$ ) and how quickly we switch from learning to working ( $dk_t/dt$ ), since knowledge depreciation at the beginning of the career is expected to be rather slow.

Yet, from the standpoint of this study, it is much more interesting to consider what is going on at the end of the career. If, at this stage of the career, both  $k_t$  and  $(dk_t/dt)$  are already small, the speed of knowledge depreciation ( $d\delta/dt$ ) plays a decisive role in shaping the age–productivity curve. The more rapidly knowledge depreciates, the faster one's productivity declines. The only way to overcome this accelerating knowledge depreciation is to continue learning, i.e. to keep  $k_t$  large and consequently, keep  $dk_t/dt$  small.<sup>2</sup> If that is not the case, the incentives to retire are increased by the lower chances of having a well-paid job at older ages.

### 3. Why might the productivity of older workers be lower in the NMS?

Taking the above into account, it seems that the NMS are likely to be among the first countries to experience a higher than average productivity cost as a result of an ageing workforce in the near future.

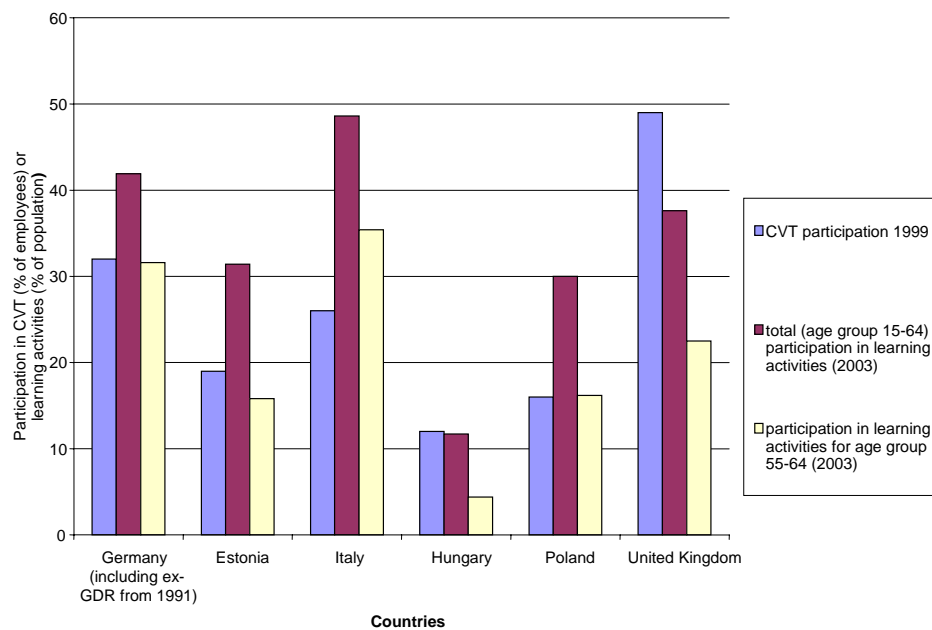
During the last several years, the NMS have been experiencing the swift structural reform of their economies accompanied by the related technological change (supposedly more rapid than in other EU countries), i.e.  $(d\delta/dt)$  is relatively large there. These processes are not likely to abate in the near future since the structure of the NMS economies and their technological advancement still differ from EU and OECD averages.

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<sup>2</sup> For the sake of simplicity, we abstract here from the real effectiveness of the learning process, which at first depends on the quality of the education curricula and also tends to decrease with age (with declining cognitive abilities).

Nor do the NMS seem able to overcome this problem by increased  $k_t$ . The participation rates in continuous education in these countries are much lower than in the EU-15. Only about 10-20% of employees participate in continuous vocational training activities in Estonia, Poland and Hungary, whereas the lowest share for the EU-15 is 26% in Italy. Similar proportions can be observed if the share of the working age population participating in any educational activity is taken into account. Hungary has the lowest rates of participation, with only 4.4% of the population aged 55-64 continuing to learn, whereas in the EU-15 this share varies from 22% (in the UK) to 35% (in Italy).

Figure 1. Participation in education activities in selected NMS and EU-15 countries



Note: CVT refers to continuous vocational training.

Source: Eurostat.

Participation in continuous learning is not only below average, but also in some NMS the average level of the acquired formal education of the labour force is slightly below the OECD average (OECD, 2005). Yet it is not just the level of education that determines the productivity of a worker. It is partly (if not mainly) the quality of the education curricula. Comparative studies on the quality of education seem to suggest that, currently, there are quality deficiencies in the educational systems of some NMS (OECD, 2005). One might suspect – although because of the lack of data it is impossible to verify the hypothesis – that similar differences likewise existed in the past, which would result in the lower relative productivity of older workers.

The labour market statistics in the NMS also suggest that the productivity of the older labour force in these countries may be lower than that of the EU-15. In most of the NMS, systematically lower labour-market participation rates can be observed for the older population than the OECD average (OECD, 2006). This outcome may be the static effect of the relatively low level of productivity of older workers in the NMS for all the above-mentioned reasons. If this is true, then it should be observable in the data. Furthermore, it can also be expected that this productivity gap will remain in the future, and, as a result, that participation rates either will not converge or will converge very slowly on the OECD average.

#### 4. Basic empirical results

The research strategy in this study is based on the assumption that in general, wages are correlated with productivity at the individual level and, as such, can be used as a proxy for productivity. Obviously, such an assumption is quite bold and may be criticised based on the results of numerous studies proving that the wages of older workers in general tend to exceed their respective productivity levels (see for example Lazear, 1981; Hellerstein & Neumark, 2004; and other studies cited by the OECD, 2006).

Yet there is also evidence that wages are correlated with productivity for some specific categories of workers, mainly those working in basic industries and jobs requiring less skill (Daveri & Meliranta, 2006; Hellerstein & Neumark, 1995). In addition, it seems that wages rise more steeply with age for highly educated staff (OECD, 2006), which suggests that the problem of a seniority premium is less pronounced among those with lower qualifications. Some earlier studies indicate that high wages for older workers are related to their longer working tenures for a single employer; therefore, wages can be better proxies for a productivity decline related to ageing when controlling for working tenure. Based on this evidence, apart from estimating the age–wage curves for the general population of workers, an estimation is also made of the age–wage curves for workers characterised by a low education level (general secondary at most), performing simpler tasks (ISCO 5 and above) and who work in competitive sectors of the economy (construction, manufacturing and market services). It is assumed that for these categories of workers, age–wage profiles closely reflect unobservable age–productivity profiles.

Using these estimated proxies for the age–productivity profiles, the analysis shows that in the NMS, the productivity of unskilled workers begins to fall earlier than it does in the EU-15. And while the age–productivity profiles are flatter in all the NMS than in the EU-15, the lower age of maximum earnings results in a lower average rate of relative productivity of older workers in comparison with workers in their prime or younger workers. Furthermore, preliminary evidence reveals that the lower relative productivity of the older unskilled workers results in a lower relative employment rate of this group in the NMS.

This study also examines micro data from six European countries: three from the EU-15 (Germany, Italy and the UK) and three from the NMS (Estonia, Hungary and Poland). One of the EU-15 countries analysed, Italy, also belongs to the group of southern European countries. The set of countries analysed is strictly related to the availability of data (Table 1 shows details of the datasets used).

*Table 1. Data used and their characteristics*

Country	Name of dataset	Year	Number of observations available for modelling (full-time workers willing to disclose their earnings)	Wage variable used (in Natural Logarithms)
Estonia (NMS)	Labour Force Survey	2004	5,158	Net wage in main job
Germany (EU-15)	German Socio-Economic Panel	2005	6,050	Net income last month in the main job
Hungary (NMS)	Labour Force Survey	2004	5,323	Net monthly income in the main job
Italy (EU-15)	IPSOS survey of Italian households' income and wealth	2004	4,821	Annual net income from main employment in 2004
Poland (NMS)	Labour Force Survey	2004	34,197	Net monthly income in the main job
UK (EU-15)	Labour Force Survey	2005	13,102	Gross hourly pay in the main job

*Source:* Author's compilation.



The model specifications across countries hardly differ, with minor differences stemming primarily from variations in definitions and coding between datasets. In all cases, the log-linear empirical wage model of the following form has been estimated.

$$\ln(w) = \alpha_1 + \alpha_2(a) + \alpha_3(a^2) + \alpha_4(t) + \alpha_5(e) + \alpha_6(g) + \alpha_7(p) + \alpha_8(s) + e$$

where  $w$  stands for wage,  $a$  for age,  $t$  for tenure,  $e$  for the highest level of education obtained,  $g$  for gender,  $p$  for the ISCO profession (at the single-digit level) and  $s$  for the sector of economy of the current employer and  $e$  for the error term. All variables with the exception of age and tenure have been expressed as dummies.

The model has been estimated only for full-time employees and the (log of) net wages in the main job has been used as the dependent variable. The UK is the only country for which gross rather than net wages have been used, because of data limitations.

Apart from estimating the wage model for the full sample, estimations have also been run for various groups of employees, assembled by their profession, level of education and sector of employment. The most interesting results with respect to this study are the resulting shapes of the age–wage curves (as described by the parameters  $\alpha_2$  and  $\alpha_3$ ) in each country and for the cases analysed.

A summary of the results of these estimations is presented in Table 2. It compares selected characteristics/parameters of the age–wage curves for various groups of workers in the countries analysed.

- 1) The age at which the maximum wage is recorded indicates the general ‘location’ of the age–wage curves on the age scale. The lower the maximum is, the more that younger workers are demanded in a given market. Later, this is referred to as the **age of maximum earnings**.
- 2) The age at which earnings are the same as at age 30 (the baseline age) illustrates the relative position of older workers in the labour market in comparison with younger ones. The lower this age is, the older workers are discriminated against. This parameter depends on both the age of maximum earnings and the slope of the curve after the maximum. Later, this is referred to as the **point of return**.
- 3) The last parameter is the relation of the maximum wage to the wage at the age of 30. It illustrates the slope of the curve between age 30 and the maximum, i.e. the difference in earnings between someone who has just finished his/her apprenticeship and an experienced worker at the top of his/her career. Later in the text, this is referred to as the **earnings distance**.

The age of 30 has been selected as the baseline point of the analysis, as it is assumed to be an average kick-off point of a career. Obviously, the choice of this point is completely arbitrary. For example, in a study by the OECD (2006), the age group 25-29 is selected as the baseline. Changing this point will obviously alter the absolute values of parameters 2 (age of maximum earnings) and 3 (earnings distance), but it will not change the shape of the age–wage curves as such, i.e. it will not change the results of the analysis.

Table 2. Selected parameters of age–wage profiles in analysed countries for selected groups of employees

Column	ISCO codes (professions)*								
	1 All employed	2 ISCO 1	3 ISCO 2	4 ISCO 3	5 ISCO 4	6 ISCO 5	7 ISCO 7	8 ISCO 8	9 ISCO 9
Age of maximum earnings									
Estonia	31.7	Dec.	n.a.	n.a.	n.a.	n.a.	33.3	36.0	Dec
Hungary	46.5	Inc.	n.a.	n.a.	n.a.	41.6	n.a.	37.4	n.a.
Poland	46.6	64.5	54.7	54.1	46.3	38.6	44.9	41.9	38.6
<b>NMS (analysed) average</b>	<b>41.6</b>	<b>64.5</b>	<b>54.7</b>	<b>54.1</b>	<b>46.3</b>	<b>40.1</b>	<b>39.1</b>	<b>38.4</b>	<b>38.6</b>
Germany	45.3	48.2	49.1	43.7	46.1	41.9	43.1	41.5	41.0
Italy	46.2	57.2	43.4	n.d.	43.5	n.d.	n.d.	47.1	n.d.
UK	45.1	47.0	47.3	43.1	46.0	46.4	44.6	43.4	43.6
<b>EU-15 (analysed) average</b>	<b>45.5</b>	<b>50.8</b>	<b>46.6</b>	<b>43.4</b>	<b>45.2</b>	<b>44.1</b>	<b>43.9</b>	<b>44.0</b>	<b>42.3</b>
Age at which earnings are the same as at age 30 (point of return)									
Estonia	33.3	Dec.	n.a.	n.a.	n.a.	n.a.	36.6	42.1	Dec
Hungary	63.1	Inc.	n.a.	n.a.	n.a.	53.3	n.a.	44.8	n.a.
Poland	63.2	99.1	79.5	78.3	62.6	47.2	59.7	53.9	47.2
<b>NMS (analysed) average</b>	<b>53.2</b>	<b>99.1</b>	<b>79.5</b>	<b>78.3</b>	<b>62.6</b>	<b>50.2</b>	<b>48.1</b>	<b>46.9</b>	<b>47.2</b>
Germany	60.6	66.5	68.3	57.4	62.1	53.8	56.2	53.0	52.1
Italy	62.4	84.4	56.8	n.d.	57.0	n.d.	n.d.	64.1	n.d.
UK	60.2	64.1	64.5	56.1	62.0	62.7	59.3	56.8	57.3
<b>EU-15 (analysed) average</b>	<b>61.1</b>	<b>71.7</b>	<b>63.2</b>	<b>56.8</b>	<b>60.4</b>	<b>58.3</b>	<b>57.7</b>	<b>58.0</b>	<b>54.7</b>
Value of earnings at the maximum, with earnings at age 30=1 (earnings distance)									
Estonia	1.00	Dec.	n.a.	n.a.	n.a.	n.a.	1.00	1.01	Dec
Hungary	1.03	Inc.	n.a.	n.a.	n.a.	1.03	n.a.	1.01	n.a.
Poland	1.09	1.25	1.33	1.22	1.17	1.03	1.07	1.05	1.02
<b>NMS (analysed) average</b>	<b>1.04</b>	<b>1.25</b>	<b>1.33</b>	<b>1.22</b>	<b>1.17</b>	<b>1.03</b>	<b>1.04</b>	<b>1.02</b>	<b>1.02</b>
Germany	1.13	1.33	1.37	1.11	1.17	1.07	1.07	1.07	1.08
Italy	1.13	1.58	1.14	n.d.	1.10	n.d.	n.d.	1.14	n.d.
UK	1.15	1.27	1.27	1.13	1.11	1.20	1.10	1.07	1.10
<b>EU-15 (analysed) average</b>	<b>1.13</b>	<b>1.39</b>	<b>1.26</b>	<b>1.12</b>	<b>1.13</b>	<b>1.14</b>	<b>1.09</b>	<b>1.09</b>	<b>1.09</b>

\* ISCO codes are defined as 1) legislators, senior officials and managers; 2) professionals; 3) technicians and associate professionals; 4) clerks; 5) service workers, shop and market sales workers; 6) skilled agricultural and fishery workers; 7) craft and related trade workers; 8) plant and machine operators and assemblers; and 9) elementary occupations.

Table 2. Continued

Column	Education					Sector of employment (except agriculture)			
	10	11	12	13	14	15	16	17	18
	Tertiary	Secondary vocational	General secondary	Basic vocational	Primary or below	Construction	Manufacturing	Market services	Non-market services
Age of maximum earnings									
Estonia	n.a.	Dec.	Dec.	36.3	34.4	n.a.	32.4	27.5	n.a.
Hungary	n.a.	45.8	n.a.	39.1	dec	n.a.	37.9	43.5	58.0
Poland	51.2	49.0	44.0	41.9	39.1	43.5	50.9	43.6	50.0
<b>NMS (analysed) average</b>	<b>51.2</b>	<b>47.4</b>	<b>44.0</b>	<b>39.1</b>	<b>36.7</b>	<b>43.5</b>	<b>40.4</b>	<b>38.2</b>	<b>54.0</b>
Germany	46.5	43.1	n.d.	45.2	42.9	43.3	45.8	44.3	47.4
Italy	49.8	44.5	45.0	n.d.	n.a.	45.0	50.4	45.9	40.8
UK	45.9	42.4	44.9	46.2	44.1	44.9	45.7	44.6	46.3
<b>EU-15 (analysed) average</b>	<b>47.4</b>	<b>43.3</b>	<b>45.0</b>	<b>45.7</b>	<b>43.5</b>	<b>44.4</b>	<b>47.3</b>	<b>44.9</b>	<b>44.8</b>
Age at which earnings are the same as at age 30 (point of return)									
Estonia	n.a.	Dec.	Dec.	42.6	38.7	n.a.	34.8	30.0	n.a.
Hungary	n.a.	61.5	n.a.	48.3	dec	n.a.	45.8	56.9	86.0
Poland	72.4	68.1	58.1	53.9	48.2	57.0	71.7	57.2	70.1
<b>NMS (analysed) average</b>	<b>72.4</b>	<b>64.8</b>	<b>58.1</b>	<b>48.3</b>	<b>43.5</b>	<b>57.0</b>	<b>50.8</b>	<b>48.0</b>	<b>78.0</b>
Germany	63.1	56.2	n.d.	60.4	55.9	56.7	61.6	58.5	64.9
Italy	69.7	59.0	59.9	n.d.	n.a.	60.0	70.8	61.8	51.6
UK	61.8	54.8	59.9	62.4	58.3	59.8	61.5	59.2	62.6
<b>EU-15 (analysed) average</b>	<b>64.9</b>	<b>56.6</b>	<b>59.9</b>	<b>61.4</b>	<b>57.1</b>	<b>58.8</b>	<b>64.6</b>	<b>59.9</b>	<b>59.7</b>

Table 2. Continued

Column	Education					Sector of employment (except agriculture)			
	10	11	12	13	14	15	16	17	18
	Tertiary	Secondary vocational	General secondary	Basic vocational	Primary or below	Construction	Manufacturing	Market services	Non-market services
Value of earnings at the maximum, with earnings at age 30=1 (earnings distance)									
Estonia	n.a.	Dec.	Dec.	1.01	1.01	n.a.	1.00	1.00	n.a.
Hungary	n.a.	1.05	n.a.	1.01	dec	n.a.	1.01	1.04	1.07
Poland	1.29	1.12	1.08	1.05	1.02	1.07	1.08	1.07	1.20
<b>NMS (analysed) average</b>	<b>1.29</b>	<b>1.08</b>	<b>1.08</b>	<b>1.02</b>	<b>1.01</b>	<b>1.07</b>	<b>1.03</b>	<b>1.04</b>	<b>1.14</b>
Germany	1.21	1.14	n.d.	<i>1.10</i>	1.11	1.10	1.16	1.10	1.19
Italy	<i>1.21</i>	<i>1.11</i>	<i>1.12</i>	<i>n.d.</i>	<i>n.a.</i>	<i>1.12</i>	<i>1.19</i>	<i>1.13</i>	<i>1.04</i>
UK	1.21	1.09	1.20	1.14	1.10	1.13	1.22	1.16	1.12
<b>EU-15 (analysed) average</b>	<b>1.21</b>	<b>1.11</b>	<b>1.16</b>	<b>1.12</b>	<b>1.11</b>	<b>1.12</b>	<b>1.19</b>	<b>1.13</b>	<b>1.12</b>

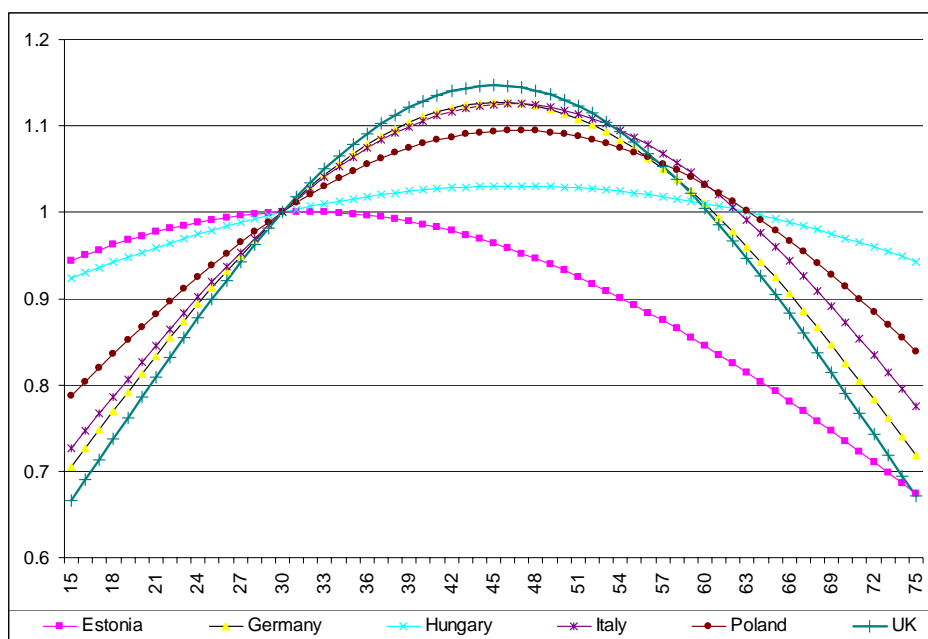
Notes: Data in italics are not fully comparable across countries; n.a. = not applicable (insignificant age coefficients in wage models); n.d. = no data, such aggregation impossible, Dec. = estimated age–wage profile was strictly decreasing with age; inc. means that the estimated age–wage profile was strictly increasing with age. The general base category for estimations is male, vocational education, ISCO 7, working in manufacturing.

Source: Author's compilation.

## 5. Looking for differences between the EU-15 and the NMS

Unweighted averages for a full sample suggest that age–wage curves do not differ significantly between the NMS analysed and the EU-15 countries. The age of maximum earnings in Poland and in Hungary is similar to the EU-15 average. The point of return in these two countries is even later than in any of the EU-15 member states. But the earnings distance for all the NMS is lower than in any EU-15 country, indicating much flatter age–wage profiles (see also Figure 2).

*Figure 2. Estimated age–wage profiles for full-time dependent employees in the selected countries in 2004 (earnings at the age of 30 are normalised to 1)*



*Source:* Author's calculations based on datasets as in Table 2.

The only NMS for which the results for the full sample differ significantly from the EU-15 is Estonia. In general, maximum earnings in this country are reached almost at the beginning of an individual's career, at the age of 32. This situation points to a very 'dynamic' labour market being practically dominated by young workers. The Hungarian case is also very interesting but from another perspective. The estimated age–wage profile for Hungary is the flattest of all the countries studied. The expected maximum career wage is only 3% higher than the wage at the age of 30. The pace at which it decreases afterwards is also extremely slow.

It could be inferred that the age–wage profiles summarised in column 1 of Table 2 and in Figure 2 (with the exception of those for Estonia) are strongly influenced by the Lazear effect<sup>3</sup> and thus do not mimic age–productivity profiles. Yet it is also widely suggested that this effect is especially strong for specific groups of workers and industries: mainly highly educated workers employed in skill-intensive and managerial positions (see OECD, 2006). Another possibility is that such a wage premium is much higher in the non-market sectors (mainly public),

<sup>3</sup> Lazear (1981) demonstrated that it might be efficient from the point of view of employers to keep wages rising with age even if productivity does not increase.

characterised by a hierarchical wage structure in which the career path and the pay ladder are very closely tied to work experience and not to observed productivity.

Therefore, in this study, the age–wage profiles are estimated for specific groups of workers grouped according to

- profession (columns 2-9 of Table 2),
- education levels (columns 10-14 of Table 2) and
- sector of employment (columns 15-18 of Table 2).

Applying such a breakdown enables the observation of further, distinct differences between the NMS and the EU-15, although it seems that the differences within these groups are even clearer.

For the four highest ISCO groups (executives, professionals, technicians and clerks – columns 2-5 in Table 2), the results for the NMS are unfortunately far from complete. In Hungary, the age–wage profiles are horizontal for most groups (insignificant coefficients). For executives (ISCO 1), the profile is strictly increasing, suggesting especially high wage premiums for older workers. In Estonia, on the other hand, the profiles are also horizontal for all ISCO levels except for ISCO 1, where the estimated age–wage curve is strictly decreasing(!).

While some of the more systematic differences in age–wage profiles between the NMS and the EU-15 start to become visible for professions requiring lower skills – ISCO 5 (sales and service workers) and below – they are not clear by any means. Age–wage profiles for ISCO 7 and 9 in Hungary are horizontal. Once again, in Estonia the age–wage relationship for ISCO 9 is strictly negative.

In general, the results for Poland are quite similar to those of Germany as well as other EU-15 countries. It is notable, however, that in the case of Poland, both the age of maximum earnings and the point of return continue to decrease as we move from complex occupations to more elementary ones – they are significantly higher than in Germany for ISCO levels 1-3 and similar or lower for ISCO 4 and below. The results for (all) EU-15 countries are much more stable in this respect, with the observed difference between Poland and Germany being the most visible one between the NMS and the EU-15 for this breakdown.

A very similar picture is obtained by disaggregating total employment with respect to the education levels of employees (see columns 10-14 of Table 2). The lower the education level analysed, the more youth-oriented and flat are the age–wage curves in the NMS. For instance, at the primary education level in Hungary, the age–wage curve is strictly negative. This tendency is not so clear in any of the EU-15 countries.

Interesting results can also be obtained by analysing the shape of the age–wage curve, disaggregated by sectors of the economy. Such an analysis has been performed for six sectors: agriculture and fishery, mining, construction, manufacturing, market services and non-market services. The latter includes public administration and public services, such as education and healthcare (see columns 15-18 in Table 2).

For all the countries in both the EU-15 and the NMS, the age–wage curves for agriculture and mining were horizontal and therefore, these sectors do not appear in Table 2. Horizontal age–wage curves were also obtained for the construction sector in Hungary and Estonia, and for non-market services in the latter. For the remaining sectors, there are concave age–wage curves in all the analysed countries, which seem to offer additional insight into the characteristics of the age–wage relationship.

One can distinguish among three groups of countries for the industrial sector: for Italy and for Poland, the age of maximum earnings and the point of return are the highest, and are

respectively above the ages of 50 and 70 found for Germany and the ages of 45 and 61 for the UK. For Estonia and Hungary, the age of maximum earnings is similar and clearly below 40, but the point of return already differs significantly between these two countries.<sup>4</sup>

For market services, the differences are slightly more in line with the main country groups. For all the NMS, the age of maximum earnings is lower than for any EU-15 country, but the difference between Hungary and Poland on the one hand, and Germany and the UK on the other is rather small. The age of maximum earnings is clearly the highest for Italy and the lowest for Estonia, where it falls below 30.

For non-market services, the observed differences are also in line with the country groups, but they are the opposite of what one would expect. Both the age of maximum earnings and the point of return are, in this case, much higher for the NMS (excluding Estonia, which has a horizontal curve) than for the EU-15. Moreover, the earnings distance in this sector is highest in Poland. This sector is the only one in which the old-age wage premiums in the NMS are clearly higher than in the EU-15.

To summarise, the analysis has been able to identify some differences between the NMS and the EU-15. First, for the majority of cases, the age–wage profiles in the NMS are much flatter than in the EU-15 (the earnings distance is lower). The results suggest that for qualified workers performing complex tasks, particularly in non-competitive sectors, the age premium is higher in the NMS (excluding Estonia) than it is in the EU-15. Yet, the age–wage profiles in the NMS clearly become more youth-oriented as one moves from more complex to more elementary occupations and from higher to lower education levels among workers, as well as from less competitive (non-market services) to more competitive (market services) sectors. This outcome means that the lower the suspected old-age wage premium, the lower are the relative wages of older workers in the NMS. This effect is hardly visible for the EU-15, however. Taken together, these findings seem to be in line with the main hypothesis.

## 6. Analysis of individual countries

Thus far, the analysis has focused on the systematic differences between the EU-15 and NMS country groups, and the age–wage curve characteristics in individual countries have been mentioned only as far as they represent one of the groups. This section takes a closer look at the findings for individual countries that are particularly interesting.

Estonia definitely has the most youth-oriented labour market. One reaches the maximum earnings point at the age of 31 and even younger than 30 for market services. The age–wage profile is strictly decreasing not only for elementary occupations and for those with secondary education, but also for the ISCO 1 group, i.e. legislators, senior officials and managers. This country is the only one with a strictly negative (although insignificant) bivariate correlation between the age and wages of employees. It seems that the phenomenon of the old-age wage premium simply does not exist in Estonia, and the observed age–wage relationships can be assumed to be very well correlated with age–productivity profiles.

Hungary has the flattest general age–wage profile. The maximum difference for the total age spectrum observed, between the expected earnings at the age of 15 and at the age of maximum earnings, is 12%, which seems extremely low compared with the country with the largest difference, the UK, with an earnings differential of 72%, and even the second lowest (Poland) of 39%. Hungary is the only country with a strictly increasing age–wage profile for the ISCO 1

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<sup>4</sup> Similar groupings of country characteristics can be undertaken for the ISCO 8 group, which is primarily composed of industrial workers.

group. It is also the country with the most differentiated age–wage profiles across groups of employees. One can observe (and Hungary is the only such case) both strictly increasing and strictly decreasing age–wage profiles. The age of maximum earnings for the non-market services sector is the highest of all the countries studied, whereas for all the other groups the results are closer to Estonia than to the EU-15.

Poland is the NMS country with the general age–wage profile most closely mimicking the average profile for the EU-15. Significant differences appear, however, when analysing specific groups of employees. For complex professions associated with higher education levels, the age–wage profiles in Poland indicate a very high old-age premium, much higher than in any EU-15 country. The same applies to profiles in the non-market services sector, and to some extent in the industrial sector. On the other hand, for jobs requiring less education and for the most competitive sector of market services, age–wage profiles in Poland indicate low old-age premia – significantly lower than in the EU-15.

The general age–wage profiles in Germany and the UK are quite similar. Some variability of results appears for specific groups of workers, but even taking those into account the results in the UK and Germany are rather stable across all the groups analysed. The age of maximum earnings in Germany varies from 41 to 49.1 and in the UK from 43.1 to 47.3, whereas in Poland, for example, it varies from 38.6 to 64.5.

The Italian case seems to be closest to the NMS as it is also characterised by large differences in age–wage profiles among various groups of workers, although they are still much smaller than in Poland or even in Hungary. The general age–wage profile in Italy indicates a relatively substantial old-age premium: both the age of maximum earnings and the point of return are highest in Italy. This result primarily pertains to the more extreme trends favouring older workers in the age–wage profiles for ISCO 1 workers and those with tertiary education. It seems that age premiums for this kind of worker in Italy are especially high.

## **7. Analysis of the selected group of employees**

As earlier literature on the subject suggests and as the results of this study indicate so far, the age–wage profiles for various groups of workers might differ significantly. The variations may result from the difference in the magnitude of old-age wage premia and also from the diverse shapes of the actual age–productivity profiles. It is also suggested that old-age wage premia can be especially high in the case of better-educated employees occupying either more complex jobs or higher (managerial) positions. This explanation applies with respect to employees working in public or more general non-market sectors, characterised by a rigid wage ladder closely tied to the total acquired working experience.

The primary aim of this analysis is to search for differences in age–productivity profiles between the EU-15 and the NMS. Thus, the analysis should be limited to those groups of workers for which it is suspected that age–wage profiles are strictly correlated with age–productivity profiles. Hence, the next stage of the analysis estimates the age–wage profile for such a group of workers. The samples are limited in each country to consist solely of workers characterised by a maximum of general secondary education, occupying jobs from an elementary (ISCO 9) level to service workers (ISCO 5), and employed in the manufacturing, construction and market-services sectors.

All the characteristics of the age–wage profiles indicate systematic differences between the EU-15 and the NMS, and these differences are in line with the main hypothesis of this research (see Table 3 and Figure 3). The age of maximum earnings in all the NMS is lower than in any of the EU-15 countries; the same applies to the point of return. For all the NMS, the age–wage profiles are also flatter than in the EU-15 (as is the case for the full sample).



Table 3. Estimated characteristics of age–wage profiles for unskilled workers and relative average productivities

Row	Country	Age of maximum wage	Point of return	Earnings distance	Relative productivity $P_{old}/P_{prime}$ (%)
	(1)	(2)	(3)	(4)	(5)
1	Estonia	33.9	37.7	1.00	84.8
2	Hungary	40.3	50.6	1.02	96.6
3	Poland	40.8	51.6	1.04	92.4
<b>4</b>	<b>NMS (analysed) average</b>	<b>38.3</b>	<b>46.7</b>	<b>1.02</b>	<b>91.3</b>
5	Germany	42.5	55.1	1.07	93.5
6	Italy	46.7	63.4	1.15	100.3
7	UK	45.1	60.2	1.13	97.1
<b>8</b>	<b>EU-15 (analysed) average</b>	<b>44.8</b>	<b>59.6</b>	<b>1.12</b>	<b>96.9</b>
9	Germany, East	38.9	47.7	1.03	90.5
10	Germany, West	45.5	61.1	1.11	98.3

Notes: The age–wage profiles are for workers with a maximum of general secondary education working in manufacturing, construction and market services and occupying positions ISCO 9–ISCO 5 (columns 2–4). The relative average productivities are for the age group 50–64 in comparison with the age group 25–50 (column 5).

Source: Author’s calculations based on data as in Table 1.

The other general characteristics of the age–wage profiles in individual countries are replicated. The Estonian labour market is clearly the most youth-oriented, although in this case, the differences between Estonia and the other NMS are much smaller than for the full sample. The German age–wage profiles are the most similar to those in the NMS; however, all the characteristics still indicate higher relative wages for older workers.

The similarity of German profiles with those of the NMS can be explained by the heterogeneity of the German labour market. East Germany is in fact a transition economy, with a comparable labour force (see rows 9–10 of Table 3). The characteristics of age–wage profiles in former West Germany are very similar to those in the UK and Italy, while the age–wage profiles in former East Germany are similar to those in the NMS.

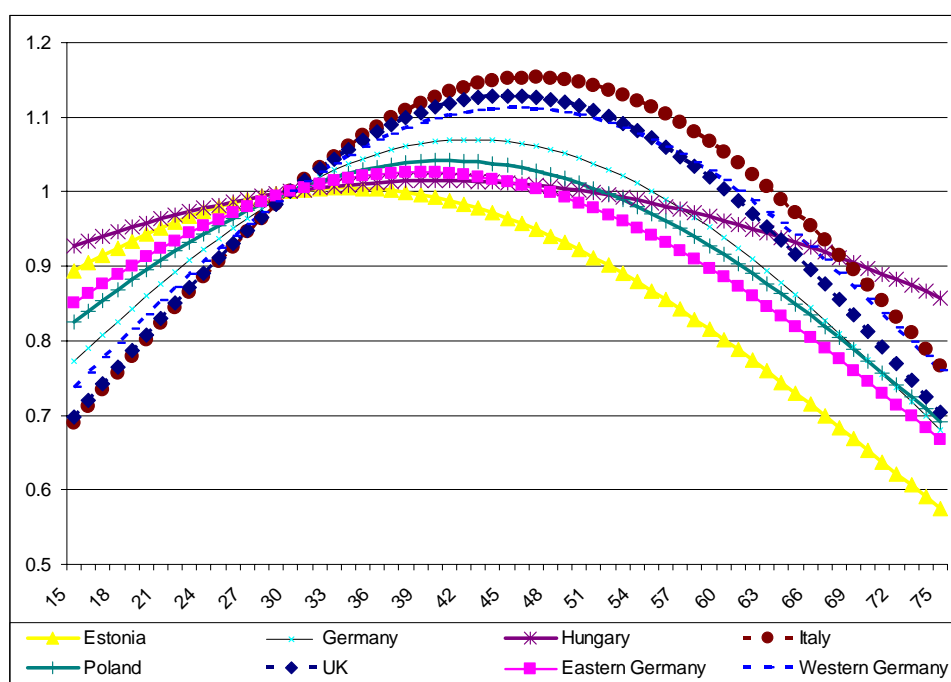
The findings of this study, particularly regarding the difference between former East and West Germany, suggest that the systematic divergence in age–wage profiles between the NMS and the EU-15 cannot result from the variation in institutional settings. First, labour market institutions differ significantly within the groups analysed (see for example Riboud et al., 2002) and second, labour market institutions do not differ between the eastern and western parts of Germany.

One can also argue that the earlier age of maximum earning and the earlier point of return do not necessarily mean that the relative productivity of older workers in the NMS is lower than in the EU-15. These outcomes could stem from much flatter age–productivity profiles in these countries.

Hence, applying the results of the estimations, the unweighted average productivities of workers in the age groups of 25–49 ( $P_{prime}$ ) and 50–64 ( $P_{old}$ ) have been calculated. Column 5 of Table 3 presents the relation of  $P_{old}$  to  $P_{prime}$  ( $P_{old}/P_{prime}$ ) in each country. It is clear that (taking into

account differences between former East and West Germany) the relative productivity of older workers in the NMS is lower than in the EU-15. This result is slightly weaker although it still holds for Hungary, where the estimated age–productivity profile is flattest.

*Figure 3. Estimated age–wage profiles for workers with a maximum of general secondary education, working in manufacturing, construction and market services and occupying positions ISCO 9–ISCO 5*



Source: Author's calculations.

Assuming that the findings for this selected group of workers (unskilled) are not strongly influenced by the old-age wage premium, it can be concluded that they result from real differences in the relative productivities of older workers in the NMS and the EU-15. If this conclusion is true, it should influence the relative employment rates of the older population. In general, employment rates for this group in the NMS should be lower than in the EU-15. This issue is analysed below.

## 8. Relative supply and employment rates of the older labour force

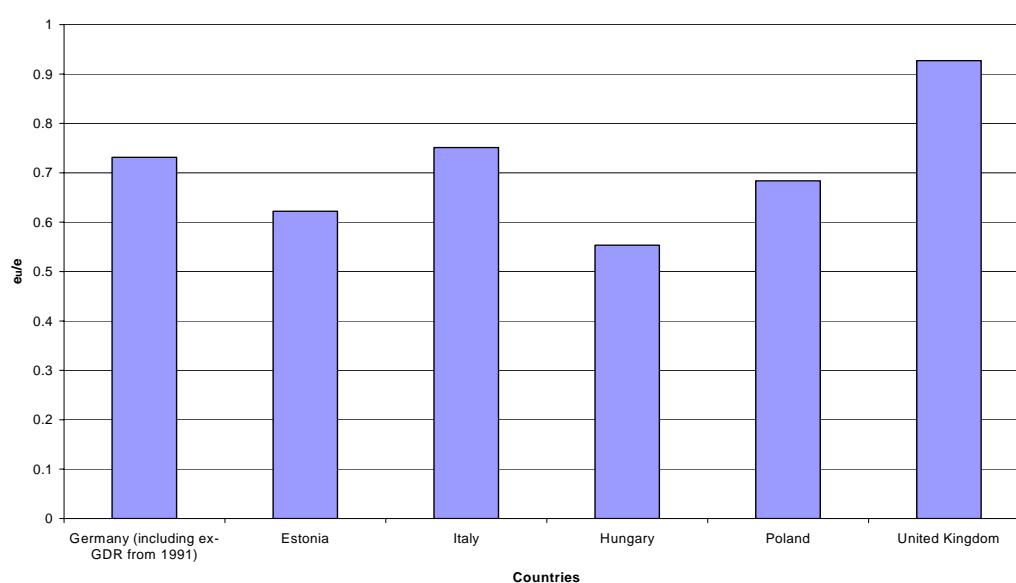
In order to examine the relationship between the relative productivity of the older, unskilled labour force and the relative employment rate of this group, one cannot simply calculate employment rates and correlate them with relative productivities as in Table 3. The general employment level of older workers does not depend solely on relative productivity levels. It is influenced by other exogenous factors such as cultural attitudes, features of the pension system and the general education structure of the older labour force.

It might be suspected that in countries characterised by strong family ties, such as Italy or Poland, the activity level of the older population may be limited, owing to numerous and not necessarily economic reasons – for example, a long tradition of grandparents caring for children. A defined-benefit pension system encouraging early retirement will negatively

influence the employment rate of older workers. A high share of the unskilled in the total population of those aged 50-64 will also limit the total employment rates of this age group, disregarding relative productivities.

Therefore, the interest here is in the relative employment rate of the unskilled older population as compared with the total employment rate for the same cohort. If  $e$  equals the employment rate for the age group 50-64 and  $e_u$  equals the employment rate for the unskilled (ISCED 0-2) belonging to the same age group, then the ‘relative employment rate’ equals  $e_u/e$ . Figure 4 presents the relative employment rates for the countries analysed. It is clearly visible that for all the NMS, the relative employment rates are lower than they are for the EU-15. This outcome seems to indicate that there is a relationship between the relative productivity differences and the employment rates of older workers and it coincides with the observed lower employment rates for this age group in the NMS.

*Figure 4. Relative employment rate of the unskilled belonging to the age group 50-64*



*Note:* If  $e$  equals the employment rate for the age group 50-64 and  $e_u$  equals the employment rate for the unskilled (ISCED 0-2) belonging to the same age group, then the relative employment rate equals  $e_u/e$ .

*Source:* Author's calculations based on Eurostat data.

Yet it can also be observed that the relative productivity differences and relative employment rate differences do not coincide when comparing individual countries within the NMS group and within the EU-15 group. This result may be attributed the fact that the age-wage curve estimated is only a proxy for the age-productivity relationship, even for the selected group of workers.

If the observed relative wages of older workers are higher than their respective relative productivities, this characteristic will obviously decrease their employment rate. This factor may explain the relatively lower employment rate in Hungary than in Estonia. In the latter case, the age-wage curve indicates a much lower relative productivity of older workers and it may reflect the actual age-productivity relationship much more closely than the flat Hungarian age-wage profile. The same applies to the relatively high employment rate of the unskilled older

population in the UK.<sup>5</sup> A high relative employment rate of the unskilled older population in Poland (higher than in Estonia) can be explained by the large share of employment in agriculture in this country.

## 9. Summary and conclusions

The main aim of this report has been to examine differences in the productivity of older workers in selected EU countries.

The initial expectation was that the productivity of older workers would be lower in the NMS. The faster decline of productivity with age in these countries may stem from two factors: 1) rapid technological change related to the swift economic transition, resulting in quicker human-capital depreciation; and 2) lower rates of participation in continuous learning, additionally strengthening the negative impact of the first factor. Similar to the entire EU, the NMS are facing accelerating rates of decline in age-related productivity. Thus, the process of labour force ageing may result in either lower employment rates of older workers or a negative influence on overall productivity (or both) and consequently, GDP growth.

In order to compare the relationship between age and productivity in the NMS and the EU-15, a series of wage models have been estimated for six countries: three belonging to the NMS and three to the EU-15. Although there are many arguments based on the Lazear effect that wages cannot be used as a proxy for productivity, there are also arguments that this effect tends to be weaker for some specific groups of employees – mainly those who occupy more elementary jobs and who have lower levels of education. It can also be expected that this effect will be weaker as the economic environment becomes more competitive. Based on these assumptions, groups of employees have been selected, matching the above characteristics. The age–wage relationships estimated for this group have subsequently been treated as a proxy for the age–productivity relationship.

The analysis has been able to show that the shape of the age–productivity curve in the NMS differs (at least for the unskilled) from that observed in the EU-15 countries. On average, an unskilled worker in one of the NMS reaches maximum productivity earlier than in the EU-15. The productivity of an older worker also tends to return sooner to the level experienced the beginning of his/her career. The average relative productivity level of older unskilled workers (aged 50-64) is also lower compared with the productivity of workers in their prime (aged 25-49) in the NMS than it is in the EU-15.

The research has moreover been able to show (although the argument here is rather weak) that the low relative productivity of unskilled older workers in the NMS negatively influences their relative employment rates.

If these results are correct, the implication is that in the NMS, employment rates are unlikely to increase significantly for the large proportion of unskilled (or mis-skilled) workers among the older or middle-aged labour force in the near future. In addition to the direct adverse impact on total employment rates, this finding has important negative consequences for fiscal tensions with respect to increasing spending needs, through either unemployment or social benefits (or both) or decreasing incomes, since these expenditures are mainly financed by labour taxes.

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<sup>5</sup> Obviously, the high wages of older workers can reduce employment because of the negative impact of high wages on demand, but on the other hand, one has to take into account their opposite effect on labour supply. Here, much depends on the characteristics of the pension system. In this context, the Estonian system is also one of the most rigid in the EU with only 6.3% of GDP spent on total pensions in 2003 (the EU-25 average was 12.6%) (data derived from Eurostat).

Obviously, this perverse characteristic of the labour supply structure in the NMS will naturally weaken because of socio-demographic processes (the cohort effect) and the fact that the convergence process is slowing down. It will nevertheless influence the labour market prospects of these countries for at least the next several years. The negative effects of these trends could be limited by developing an efficient and widespread system of life-long learning and vocational training for those currently in their 30s and 40s, and by improving the quality of the general education system. It seems that from the viewpoint of the labour market this should be the key priority for public spending in the near future. It also appears that the only solution to this problem in the short run is to reduce the labour costs of vulnerable groups of workers.

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## About AIM (Adequacy & Sustainability of Old-Age Income Maintenance)

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The AIM project aims at providing a strengthened conceptual and scientific basis for assessing the capacity of European pension systems to deliver adequate old age income maintenance in a context of low fertility and steadily increasing life expectancy. The main focus is on the capacity of social security systems to contribute to preventing poverty among the old and elderly and more generally to enable persons to take all appropriate measures to ensure stable or “desired” distribution of income over the full life cycle. In addition it will explore and examine the capacity of pension systems to attain broad social objectives with respect to inter- and intra generational solidarity.

Furthermore it will examine the capacity of pension systems to allow workers to change job or to move temporarily out of the labour market and to adapt career patterns without losing vesting of pensions rights. The project will also address the specific challenges with respect to providing appropriate old age income for women.

A general objective of the research project is to clearly identify and analyse the potential trade-offs between certain social policy objectives and overall stability of public debt.

AIM is financed under the 6th EU Research Framework Programme. It started in May 2005 and includes partners from both the old and new EU member states.

### Participating institutes

- Centre for European Policy Studies, CEPS, Belgium, coordinator
- Federal Planning Bureau, FPB, Belgium
- Deutsches Institut für Wirtschaftsforschung (German Institute for Economic Research), DIW, Germany
- Elinkeinoelämän tutkimuslaitos, (Research Institute of the Finnish Economy), ETLA, Finland
- Fundación de Estudios de Economía Aplicada, FEDEA, Spain
- Social and Cultural Planning Office, SCP, Netherlands
- Istituto di Studi e Analisi Economica (Institute for Studies and Economic Analysis), ISAE, Italy
- National Institute for Economic and Social Research, NIESR, United Kingdom
- Centrum Analiz Społeczno-Ekonomicznych (Center for Social and Economic Research), CASE, Poland
- Tarsadalomkutatasi Informatikai Egyesüles (TARKI Social Research Informatics Centre), TARKI, Hungary
- Centre for Research on Pensions and Welfare Policies, CeRP, Italy
- Institute for Economic Research, IER, Slovak Republic
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## About ENEPRI

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The European Network of Economic Policy Research Institutes (**ENEPRI**) is composed of leading socio-economic research institutes in practically all EU member states and candidate countries that are committed to working together to develop and consolidate a European agenda of research. **ENEPRI** was launched in 2000 by the Brussels-based Centre for European Policy Studies (CEPS), which provides overall coordination for the initiative.

While the European construction has made gigantic steps forward in the recent past, the European dimension of research seems to have been overlooked. The provision of economic analysis at the European level, however, is a fundamental prerequisite to the successful understanding of the achievements and challenges that lie ahead. **ENEPRI** aims to fill this gap by pooling the research efforts of its different member institutes in their respective areas of specialisation and to encourage an explicit European-wide approach.

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CASE	Center for Social and Economic Research, Warsaw, Poland
CEE	Center for Economics and Econometrics, Bogazici University, Istanbul, Turkey
CEPII	Centre d'Études Prospectives et d'Informations Internationales, Paris, France
CEPS	Centre for European Policy Studies, Brussels, Belgium
CERGE-EI	Centre for Economic Research and Graduated Education, Charles University, Prague, Czech Republic
CPB	Netherlands Bureau for Economic Policy Analysis, The Hague, The Netherlands
DIW	Deutsches Institut für Wirtschaftsforschung, Berlin, Germany
ESRI	Economic and Social Research Institute, Dublin, Ireland
ETLA	Research Institute for the Finnish Economy, Helsinki, Finland
FEDEA	Fundación de Estudios de Economía Aplicada, Madrid, Spain
FPB	Federal Planning Bureau, Brussels, Belgium
IE-BAS	Institute of Economics, Bulgarian Academy of Sciences, Sofia, Bulgaria
IER	Institute for Economic Research, Bratislava, Slovakia
IER	Institute for Economic Research, Ljubljana, Slovenia
IHS	Institute for Advanced Studies, Vienna, Austria
ISAE	Istituto di Studi e Analisi Economica, Rome, Italy
NIER	National Institute of Economic Research, Stockholm, Sweden
NIESR	National Institute of Economic and Social Research, London, UK
NOBE	Niezalezny Ośrodek Badań Ekonomicznych, Łódź, Poland
PRAXIS	Center for Policy Studies, Tallinn, Estonia
RCEP	Romanian Centre for Economic Policies, Bucharest, Romania
SSB	Research Department, Statistics Norway, Oslo, Norway
SFI	Danish National Institute of Social Research, Copenhagen, Denmark
TÁRKI	Social Research Centre Inc., Budapest, Hungary

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